ANL/EAD/TM-103

Data Management Plan for the Installation Restoration Program at Yuma Proving Ground, Arizona

Environmental Assessment Division
Argonne National Laboratory

Operated by The University of Chicago,
under Contract W-31-109-Eng-38, for the

United States Department of Energy

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Data Management Plan for the Installation Restoration Program at Yuma Proving Ground, Arizona

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February 2001

Work sponsored by Environmental Sciences Division, U.S. Army Yuma Proving Ground, Arizona

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FOREWORD

This document presents the data management plan (DMP) for the characterization of contamination to be conducted as part of the Resource Conservation and Recovery Act (RCRA) corrective action involving selected sites (e.g., solid waste management units [SWMUs]) at Yuma Proving Ground (YPG), Arizona. The RCRA will be conducted under the direction of YPG, in coordination with the State of Arizona Department of Environmental Quality (ADEQ). As directed by the ADEQ and in agreement with YPG, the investigation and restoration of selected sites will follow the format established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (*Code of Federal Regulations*, Title 40, Part 300). A remedial investigation (RI) will be performed, and if it is determined that sites warrant some type of additional action (e.g., remediation), a feasibility study (FS) will follow. The RI/FS will be conducted in compliance with policies and procedures established under the U.S. Army Environmental Center (AEC) Investigation Restoration Program (IRP) and related programs.

A DMP is an essential tool for all project managers and planners to identify and document appropriate requirements and responsibilities for the management, quality assurance, use, and archiving of data collected by a project. The DMP has a four-fold purpose: (1) document the design of a system to manage data, (2) specify data management requirements and applicable procedures, (3) outline expected data types and data flows, and (4) specify staff roles and responsibilities for managing data. This document is modeled on the *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs* (American Society for Quality Control 1994) and on *Developing, Implementing, and Maintaining Data Management Implementation Plans* (Byrd no date).

The DMP is one of a series of documents that support the YPG RI/FS. Another document in the series is the two-volume *Remedial Investigation Sampling and Analysis Plan for Selected Sites at Yuma Proving Ground, Arizona*. Volume 1 (ANL/EAD/TM-95; Martino et al. 2000) is the field sampling plan (FSP), and Volume 2 (ANL/EAD/TM-96; Kimmell et al. 2000) is the quality assurance project plan (QAPP). Other documents in the series include *Remedial Investigation/ Feasibility Study Work Plan for Selected Sites at Yuma Proving Ground, Arizona* (ANL/EAD/TM-102; Patton et al. 2000) and *Community Involvement Plan for the Yuma Proving Ground Installation Restoration Program* (Hocking 2000). To avoid redundancy, the DMP cites relevant information in these other documents wherever possible.

NOTATION

ADEQ	Arizona Department of Environmental Quality
AEC	U.S. Army Environmental Center
ANL	Argonne National Laboratory
ASQC	American Society for Quality Control
ATEC	U.S. Army Test and Evaluation Command
BOR	Bureau of Reclamation (U.S. Department of the Interior)
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chain-of-custody
CWA	chemical warfare agent
DENIX	Defense Environmental Network and Information Exchange
DERP	Defense Environmental Restoration Program
DMO	Data Management Officer
DMP	data management plan
DMS	data management system
DPG	Dugway Proving Ground
DQO	data quality objective
DRC	Document Retrieval Center
DSERTS	Defense Site Environmental Restoration Tracking Systems
DTC	Developmental Test Command (U.S. Army)
EPA	U.S. Environmental Protection Agency
ERDE	Environmental Restoration Data Exchange
ERIS	Environmental Restoration Information System
FS	feasibility study
FSP	field sampling plan
GIS	geographic information system
GPS	global positioning satellite
IAP	installation action plan
IRA	interim remedial action
IRDMIS	Installation Restoration Data Management Information System
IRP	Installation Restoration Program

NOTATION (Cont.)

MaDCoW	Maps and Data Coming over the Web (program)
OU	operable unit
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
POL	petroleum, oil, and lubricant
PVC	polyvinyl chloride
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	quality assurance project plan
QC	quality control
RA	remedial action
RI	remedial investigation
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act
SI	site inspection
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TPH	total petroleum hydrocarbons
UTM	Universal Transverse Mercator
VOC	volatile organic compound
V&V	verification and validation
YPG	Yuma Proving Ground (U.S. Army)

DATA MANAGEMENT PLAN FOR THE INSTALLATION RESTORATION PROGRAM AT YUMA PROVING GROUND, ARIZONA

by

L. Poch, C.Y. Yuen, and T. Patton

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this data management plan (DMP) is to document: (1) the design of the data management system (DMS), (2) data management requirements and applicable procedures, (3) expected data types and data flows, and (4) staff roles and responsibilities for managing data associated with the U.S. Army's Installation Restoration Program (IRP) at Yuma Proving Ground (YPG). The IRP was established in 1975 to identify, investigate, and clean up contamination on Army properties. The program is conducted under the auspices of the Defense Environmental Restoration Program (DERP) as established by the Superfund Amendments and Reauthorization Act (SARA) in 1986. The IRP process consists of three steps: (1) preliminary assessment/site inspection (PA/SI), (2) remedial investigation/feasibility study (RI/FS) and record of decision (ROD), and (3) interim remedial action (IRA) and remedial action (RA). The scope of this DMP is limited to information needed to perform the YPG sitewide RI/FS.

The primary purpose of the environmental DMS is to make it possible to efficiently store and retrieve technically and legally defensible data that will provide the basis for making sound environmental decisions. Data may be in an electronic or hard-copy format and may be generated by the project or obtained from sources outside the project. Data relevant to the YPG RI/FS include (1) historical documentation of site activities that identify potential contamination and previous investigations; (2) state and federal standards and guidelines for remediation of soil and groundwater contamination; (3) analytical results of soil and groundwater samples collected during the project (including field measurements and laboratory analyses); (4) spatial measurements identifying sample locations; (5) field notes and observations; (6) aerial photographs and maps; and (7) project documentation, including project planning documents, project communications, and project deliverables. Certain types of data, such as the installation action plan (IAP), funding obligation plans, "cost-to-complete" evaluations, and Defense Site Environmental Restoration Tracking Systems (DSERTS) data, are outside the scope of this DMP, because these data are maintained by the U.S. Army Test and Evaluation Command (ATEC), U.S. Army Developmental Test Command (DTC), and U.S. Army Environmental Center (AEC).

1.2 YPG OVERALL PROJECT MISSION

The overall objective of the YPG IRP is to characterize and, if necessary, reduce or remove risks to human health and the environment from contaminants released by solid waste management units (SWMUs) at YPG. The IRP is being conducted under the direction of YPG. The program is beginning with an investigation of the extent of contamination at 19 SWMUs. This investigation will follow the format established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as directed by the State of Arizona and in agreement with YPG and ATEC (i.e., an RI/FS work plan, field sampling plan (FSP), quality assurance project plan (QAPP), and other documents will be prepared). Other SWMUs may also be investigated as required by YPG and the State of Arizona. In addition, the RI/FS will be conducted in compliance with policies and procedures established under the Army's IRP and related programs. The RI/FS will be implemented by YPG and a team of supporting contractors.

1.3 YPG RI/FS PROJECT TEAM

The current YPG RI/FS project team consists of nine organizations, including an Arizona regulatory agency, federal government agencies, and supporting contractors. The organizations are spread across the United States; locations include Washington, D.C.; Maryland; Illinois; and Arizona. The organizations and their roles in the project are as follows:

- *YPG*: Is the project sponsor and primary decision maker.

- *DTC*: Is a major subordinate command of the U.S. Army ATEC and the Army's premier materiel testing organization for weapons and equipment. It has technical and fiscal oversight of the project.

- *Arizona Department of Environmental Quality (ADEQ)*: Has state environmental regulatory oversight and approval authority over plans and reports.

- *Argonne National Laboratory (Argonne or ANL)*: Is responsible for overall project planning and coordination of project tasks, developing the DMS, authoring the DMP and other key project documents, and developing and managing an Internet web site for the project. Argonne is also responsible for implementing parts of the project FSP and overseeing the RI field work.

- *Jason Associates Corporation*: Will implement the project FSP developed by Argonne and approved by YPG and ADEQ. It will use subcontractors to assist in field sampling and analysis. Currently, subcontractors include Northwind

Environmental, Southwest Groundwater Consultants, and Turner Laboratories.

- *Bureau of Reclamation (BOR)*: Will install monitoring wells, advance subsurface borings, and implement the FSP.

Table 1.1 lists the members of the project team, including the names of the organizations, their roles, primary contacts, telephone numbers, mailing addresses, and e-mail addresses. The support contractors may change as the YPG RI/FS proceeds.

1.4 DATA MANAGEMENT OBJECTIVES

The data management objectives for the YPG RI/FS project are as follows:

1. Develop a complete and comprehensive DMS for the YPG RI/FS project. The DMS will be the repository of all data requested for and generated by project activities. The DMS will be used by project team members to process data for analysis and to communicate data to each other, interested stakeholders, and the general public.

2. Help project team members address data management issues, especially those pertaining to data collection, transfer, maintenance, documentation, and archiving.

Data management activities for the YPG RI/FS project will encompass the collection, storage, transfer, and use of data. Specific activities will include (1) developing a DMS to be used by the YPG RI/FS project team, (2) developing a DMP to define the protocols to be used for documenting data collection and transfer, and (3) instructing the project team on how to implement the data management protocols.

1.5 REPORT ORGANIZATION

This document is modeled on *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs* (American Society for Quality Control [ASQC] 1994) and on *Developing, Implementing, and Maintaining Data Management Implementation Plans* (Byrd no date). Section 1 presents the purpose and scope of the DMP and identifies key organizations and primary contacts. Section 2 describes the overall technical approach to data management. It includes a summary of the types of data that will be collected and generated.

TABLE 1.1 Organizational Information

Organization	Role	Primary Contact	Telephone Number	Mailing Address	E-mail Address
Arizona Department of Environmental Quality	State regulator	Moses Olade	602/207-4245	Arizona Department of Environmental Quality 3033 N. Central Avenue Mailcode 2809 M0701C Phoenix, AZ 85012	olade.moses@ev.state.az.us
Yuma Proving Ground	Project sponsor and primary decision maker	Chuck Botdorf, YPG Program Manager	520/328-2754	U.S. Army Yuma Proving Ground STEYP-DC-ES, Building 3021 Yuma, AZ 85365-9107	Charles.Botdorf@yuma-exch1.army.mil
U.S. Army Developmental Test Command	Primary decision maker	Nancy Kosko	410/278-1083	HQ U.S. Army Test and Evaluation Command ATTN: ASTME-EM-E Aberdeen Proving Ground, MD 21005-5005	koskon@dtc.army.mil
Argonne National Laboratory	Overall project planning and coordination, member of Sampling and Analysis Team	Lou Martino, ANL Project Manager	202/488-2422	955 L'Enfant Plaza, North, S.W. Suite 6000 Washington, DC 20024	martinol@anl.gov
		Terri Patton, ANL Project Coordinator	630/252-3294	9700 S. Cass Avenue Argonne, IL 60439	tlpatton@anl.gov
Bureau of Reclamation	Monitoring well and vapor extraction well drilling contractor	Russ Phelps	520/343-8372	Bureau of Reclamation Yuma Area Office 7301 Calle Agua Salada Yuma, AZ 85364-9763	rphelps@lc.usbr.gov
Jason Associates Corporation	Manager of Sampling and Analysis Team	Bruce Goff	520/328-3916	Yuma Proving Ground Building 2100, RM 40 Yuma, AZ 85366	bgoff@jason.com
North Wind Environmental	Member of Sampling and Analysis Team	Sylvia Medina	907/242-1877	P.O. Box 231054 Anchorage, AK 99523	rtk@alaskalife.net

TABLE 1.1 (Cont.)

Organization	Role	Primary Contact	Telephone Number	Mailing Address	E-mail Address
Turner Laboratories	Member of Sampling and Analysis Team	Nancy Turner	800/882-5804	2445 North Coyote Drive Suite 104 Tucson, AZ 85745	turnerlabs@aol.com
Southwest Groundwater Consultants	Member of Sampling and Analysis Team	William Wellendorf	520/771-0610	P.O. Box 2013 Prescott, AZ 86302	sgc@northlink.com

during the RI/FS, the data management rationale, and a general description of the DMS. The components of DMS are described in detail in Section 3.

Section 4 summarizes the data management tasks and the roles and responsibilities of project staff in implementing the DMP. A discussion of data interactions at the organizational level is also included. References cited in the report are listed in Section 5. The preparers of the DMP are listed in Section 6. The appendix presents descriptions of the various fields that make up the YPG project relational database.

2 TECHNICAL APPROACH TO DATA MANAGEMENT

This section describes the overall technical approach for managing the YPG RI/FS project data. It includes a discussion of the types of data to be collected or generated as part of the RI, the rationale for developing a well-structured DMS, and a general description of the five components that make up the physical design of the YPG RI/FS project DMS.

2.1 DATA TYPES

Many different types of data will be obtained as part of the YPG RI/FS. These include historical documents (e.g., reports, maps, drawings, photographs), regulatory standards, field measurements, field notes (e.g., logbooks, quality assurance [QA]-related forms), analytical data, visualization data, and project documentation. These data may originate as hard copies or as electronic files. Table 2.1 identifies the organizations that will use the different types of data.

2.1.1 Historical Documents

Project staff performed a literature search in the libraries of both YPG and Dugway Proving Ground (DPG) to find documentation of historical activities that would help identify and characterize potential contamination at the SWMUs. Images of applicable reports were copied to four CD ROMs. Hard copies of each report cover and outline were made; the hard copies and CD ROMs are archived in Argonne’s Document Retrieval Center (DRC).

Soil and groundwater samples had been previously collected at several SWMUs (see Table 7.1 of the RI/FS work plan [Patton et al. 2001]). Chemical data from investigations of these samples were compiled into an Excel spreadsheet that was provided in Appendix A of the work plan. The spreadsheet is also available to authorized parties through the Environmental Restoration Data Exchange (ERDE) web site (http://web.ead.anl.gov/ypg) or the DRC.

It is likely that other relevant historical data will be uncovered during the RI/FS. If they are found, the YPG RI/FS project team will be notified, and the data will be added to the Excel spreadsheet and archived in the DRC to allow easy access for all project team members.

2.1.2 Regulatory Standards

Both Arizona and federal standards and guidelines for soil and groundwater were used to develop human health and ecological risk screening values for the preliminary risk screening and

TABLE 2.1 Data Use by Organization

	Information Types						Project Documentation		
Organization	Historical Documents	Regulatory Standards	Field Measurements	Field Notes	Analytical Data	Visualization Data	Project Planning Documents	Project Communications	Final Project Deliverables
YPG	X	X	X	X	X	X	X	X	X
ATEC			X (ERIS)	X	X	X	X	X	X
ADEQ		X	X	X	X	X	X	X	X
Argonne	X	X	X	X	X	X	X	X	X
Jason Team and BOR			X	X	X	X	X	X	
Public							X	X	X

final risk evaluation (see Figure 3.1 of the RI FSP [Martino et al. 2000]). A database of potential screening values was developed and used to generate the tables shown in Appendix C of the RI QAPP (Kimmell et al. 2000). These data have been incorporated into the YPG project relational database and can be queried as needed.

2.1.3 Field Measurements

Field measurements will include results from analyses of soil and groundwater made on site. Soil analyses may cover metals, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), gamma spectroscopy, headspace analysis, active soil gas analysis, and soil physical parameters. On-site groundwater analyses will cover gamma spectroscopy, headspace analysis, and natural attenuation screening parameters (see Tables 2.1 and 2.2 of the QAPP). In addition, the global positioning satellite (GPS) or other methods will take spatial measurements in the field to record sampling locations and designated reference points at each SWMU.

2.1.4 Field Notes

Field notes will include notes in logbooks and a variety of QA-related forms. Logbook notations will be key elements because they document field measurements and provide other important details on each sampling event (e.g., time and date of collection, field sample number, sample location, well design and logs, procedures used, field observations). Appendix A of the QAPP contains standard operating procedures (SOPs) for keeping field notes. SOPs 003 and 016 provide guidelines for field logbook notations, and SOP 019 provides guidelines for documenting monitoring well installations and stratigraphic logs.

QA-related forms include chain-of-custody (COC) forms (SOP 002) that originate in the field and accompany the sample to the laboratory and forms completed by the ANL QA Officer (QAO) that document the results of readiness reviews and various laboratory and field audits (see also Section 4 of the QAPP).

2.1.5 Analytical Data

Analytical data will consist of laboratory measurements of selected analytes or analyte suites from various soil and groundwater samples collected at YPG, including background and duplicate samples. These include metals; petroleum, oil, and lubricant (POL) hydrocarbons; volatile organic compounds (VOCs); semivolatile organic compounds (SVOCs); solvents; PAHs; TPH; PCBs; pesticides; explosives-related compounds; chemical warfare agents (CWAs) and related compounds; natural attenuation screening parameters (groundwater only); and passive soil gas (see Table 2.3 of the QAPP).

These data, along with data qualifier notations, will be compiled and formatted by the analytical laboratory in accordance with the requirements of the YPG project relational database at Argonne as described in Section 3.1.2 and Appendix A of this DMP. Data will be transmitted to Argonne in both hard-copy and electronic format. Throughout the project, Argonne will transfer the analytical data to AEC's Environmental Restoration Information System (ERIS).

2.1.6 Visualization Data

Visualization data will consist of all data (e.g., GPS measurements) and data files (subsets of the YPG project relational database) used to make maps and other visual images (e.g., geophysical data presentations, photographs) of the YPG SWMUs.

2.1.7 Project Documentation

Project documentation will include three types of data: project planning documents, communications, and final project deliverables. Project planning documents will include work plans developed by Argonne that outline the plans for data collection activities. Communications will comprise correspondence among project organizations (e.g., project status reports, report cover letters, e-mail messages, and web site contents). Argonne staff created a project e-mail account to keep track of internal e-mails related to the YPG RI/FS project. Final project deliverables (e.g., technical updates, the RI, risk assessment reports) will be documents that contain summaries of data collection activities and data analyses.

2.2 DATA MANAGEMENT RATIONALE

Effective data management is a key to the success of any large project. It is especially important to the YPG RI/FS project for several reasons. First, this project involves studies of many sites and the collection of a considerable amount of data. The data will need to be processed and manipulated to perform screening analyses and baseline risk assessments (BRAs); model site characteristics (e.g., groundwater, vadose zone); prepare documentation (e.g., task reports, project reports); and draw maps, charts, and figures, among other tasks. Furthermore, the spatial components of the data and the ability to visualize the data (i.e., view it on a site map) will be very crucial to the analyses.

Second, the project will demand good communication. Good communication will be important because the project team is composed of many organizations separated by large distances. Good communication will require the archiving of and quick access to documentation, maps, photographs, and important project correspondence (i.e., letters and e-mails); standardized data and report formats; quick access to accurate, valid data; and error-free or near-error-free data entry and transmission.

Third, key decisions in the YPG RI/FS project will need to be based on good, defensible data. Decisions on why a site should continue to the remediation phase or be eliminated from consideration (i.e., be proposed for no further action) will have to be clearly stated and defensible to regulators and stakeholders.

Finally, project stakeholders, including the general public, will need to have access to selected project information (e.g., some project reports; visual data, such as maps, before-and-after photographs, and diagrams; project status sheets and schedules). An Internet web site is an ideal way to communicate this information to the public.

2.3 DEVELOPMENT OF A COMPREHENSIVE DATA MANAGEMENT SYSTEM

As a result of the rationale described above, a comprehensive DMS was developed for the YPG RI/FS project. The following subsections discuss the database approach adopted, the physical structure of the DMS, and data quality issues.

2.3.1 Enterprise Database Approach

Because activities associated with the YPG RI/FS project require the manipulation of a great deal of data and the sharing of these data among team members from many organizations, an enterprise database approach was adopted to manage the data. This approach emphasizes the integration and sharing of data throughout an enterprise (in this case, a team consisting of nine organizations). The enterprise database approach offers a number of advantages for data processing (McFadden et al. 1999), which include the following:

- Because the data are independent from the application programs that use them, the data or the application programs can change or evolve without necessitating a change in the other factor.

- Data redundancy is minimized; that is, data files are integrated into a single, logical data structure.

- Data consistency is improved. Reducing or eliminating data redundancy reduces opportunities for inconsistency.

- Data sharing is improved because the system is designed for use by the entire enterprise.

- New database applications can be developed quickly and inexpensively.

- Enforcing database standards is easy, provided there is a strong database administration function.

- Data quality is improved, because database designers can specify integrity constraints that are enforced by the DMS.

- Data are easier to use. End users with little or no programming experience can easily retrieve and display data.

- Program maintenance is reduced, largely as a result of the relative independence of the data from the application programs.

However, before an enterprise database approach is adopted, several requirements must be met. Because data are shared across an enterprise, security procedures must be developed to minimize the potential for data corruption (both intentional and unintentional) and for unauthorized access. Also, because a shared database must be accurate and available at all times, comprehensive procedures must be developed for providing backup copies of data and restoring the database when damage occurs.

2.3.2 Structure of the YPG Data Management System

The first step in developing a DMS for the YPG RI/FS project was enterprise database modeling. This technique is used to establish the range and general contents of an enterprise database (McFadden et al. 1999). The functions or activities to be carried out in the YPG RI/FS project were disaggregated into progressively greater levels of detail. One objective of this modeling exercise was to identify “entities” or “objects” for each activity that require data to be input if that activity is to be performed. Another objective was to identify relationships among data entities, among activities, and between activities and data entities.

The YPG RI/FS project will consist of six primary activities for which data will be needed. The first activity will be investigating the operational history of each SWMU. The data to be gathered will need to cover each SWMU’s location at YPG, past activities at the SWMU, and results of previous environmental investigations. This information will provide clues on the types of contaminants and where they might be located. The second activity will be determining locations in each SWMU for soil and groundwater sampling. Information on the past history of the site, coupled with results from recent geophysical investigations, will help suggest possible locations. The third activity will be installing monitoring wells at locations identified in the previous activity. After the wells have been installed, data will need to be gathered on their locations, designs, and other features. The fourth activity will be sampling at the predetermined locations. Data to be gathered will include the name of the sample on the COC form, SWMU where the sample was taken, medium sampled (e.g., soil, surface soil, groundwater), sampling method, sampling date, and identity of the field team taking the sample. The fifth activity will be analyzing samples at an analytical laboratory for chemicals of potential concern. The laboratory will need to provide data, including the identification number assigned to the result, sample name on the COC form, medium sampled, chemical analyzed, numerical results of the analysis, analysis date, and other data related to the analysis method. Analytical data, coupled with federal and state regulatory standards and guidelines, will be used to identify sites where remedial action may be needed. The last activity will be determining the groundwater flow pattern at each SWMU. Measurements of groundwater levels will be taken each quarter at the wells drilled at each SWMU. Depending on the results of groundwater level measurements taken in the early stage of the project, more wells may need to be drilled to obtain a more complete understanding of groundwater flows.

The types and formats of current and future data are another factor to consider in developing a DMS. The data for the YPG RI/FS project will come in many different formats. Some data will come in hard-copy format, such as historical documents, reports describing current tasks, and project correspondence. Some data will come in electronic format, such as sampling and analysis results and risk screening values. There will also be photographs, maps, charts, and other spatial data, such as geographic information system (GIS) data. The project team will need to be able to search and access hard-copy and electronic data and view data in a spatial context. The DMS will also have to be able to display selected data to the public while maintaining overall database security. Consequently, the DMS must be capable of handling data formats and project team requirements seamlessly.

Argonne staff felt that a DMS structure should consist of five components to accommodate existing and planned data and project team requirements. The five components are (1) the YPG project relational database, (2) visualization tools, (3) a DRC, (4) Internet web sites, and (5) ERIS.

2.3.2.1 YPG Project Relational Database

An internal project database was developed to store site geographic data and data obtained from field surveys and sampling and analysis. Microsoft Access will be used to store data in this relational database. Data will consist of analytical results from soil, soil gas, groundwater, and waste samples taken at each SWMU of interest as well as information on geographic features of the sites.

Before the data will be entered into the database, they will be rigorously verified and validated according to the procedures described in the QAPP (Kimmell et al. 2000). Data from historical sampling activities, which have already been compiled in an Excel spreadsheet, are currently undergoing verification and validation (V&V). These data will be kept separate from the YPG project relational database until the V&V is completed. These data are now available to authorized parties on the ERDE web site or in the DRC. Images obtained from geophysical investigations at the site will also be displayed on the ERDE web site or archived in the DRC.

2.3.2.2 Visualization Tools

Visualization tools will consist of a GIS database and a web browser. The GIS will use ARC/INFO to display the data visually, perform spatial analysis, and develop maps and diagrams. Although the GIS database will be maintained separately from the YPG project relational database, it will use some of the same data. The second visualization tool, MaDCoW (Maps and Data Coming over the Web), will be used by analysts and interested stakeholders to visualize data on a site map. MaDCoW will be accessible from the ERDE web site.

2.3.2.3 Document Retrieval Center

The DRC will be the central repository for all data items, such as data reports, guidance documents, maps, work plans, and important correspondence. Electronic versions of data items, which are on permanent storage media such as CDs or floppy disks, will also be stored in the DRC. The DRC will enable project managers to maintain a complete and accurate docket of project files and provide project staff with a convenient and timely way to obtain data and documents. The docket will be the official project record and will be turned over to YPG at the end of project.

2.3.2.4 Internet Web Sites

Two web sites were developed for this project. One web site, “Environmental Restoration Data Exchange” (referred to as ERDE), is for government regulators, sponsors, and technical staff. ERDE is a repository for project-related documents, databases, and other information for the staff to use and update as needed. It is password-protected to prevent unauthorized access to sensitive or draft information. The web address is http://web.ead.anl.gov/ypg.

The second web site, “Environmental Restoration at Yuma Proving Ground” (referred to as the public web site), is for the general public. This site has publicly available documents and general information about each SWMU. The web address is http://web.ead.anl.gov/yuma.

2.3.2.5 Environmental Restoration Information System

The AEC is in the process of upgrading its own database system for managing and archiving chemical, geological, geographic, and remedial action data in support of IRP and Base Realignment and Closure activities. The new system will be known as ERIS. Data from the YPG RI/FS will be transferred to ERIS once the system is operational.

2.3.3 Data Quality

The data going into both the relational YPG project relational database and the GIS database will be carefully controlled to maintain integrity. Only a small number of project management staff members will be authorized to change or add to the data. Project managers have developed guidelines to inform the project staff about data management requirements and procedures. The guidelines are documented in this DMP and will be revised or expanded as needed through internal memoranda. All project staff members, including both Argonne staff and contractors, must be familiar with the guidelines before beginning work on the project.

3 DATA MANAGEMENT SYSTEM

This section describes the structure of the DMS supporting the YPG RI/FS project. The DMS will have five components: (1) YPG project relational database, (2) visualization tools, (3) the DRC; (4) ERDE and Environmental Restoration at Yuma Proving Ground web sites, and (5) ERIS. Each component is described in detail in the following subsections.

3.1 YPG PROJECT RELATIONAL DATABASE

This relational database, which makes use of Microsoft Access, was developed to store geographic data and results from sampling and analysis. It consists of data files to support project work, the MaDCoW program, and the Internet web sites. Data files for the YPG project relational database will include numerical data from sampling and analysis activities performed at the SWMUs, regulatory standards for chemical contamination of soil and groundwater, and other data. Data files for the MaDCoW program will include spatial or descriptive information about site features and other geographic images, such as background aerial photographs. Data files for the web sites will include project personnel information, security information, and image/photographic information.

3.1.1 Using the YPG Project Relational Database

Project team members will use the relational database to perform analyses and develop information to include in project reports. Figure 3.1 is a diagram showing the entities or objects for which data are required and the relationships between the entities. Six entities make up the database; they are depicted as tables in the figure. The tables are the SWMUs Table, Well Table, Groundwater_Level_Table, Sample_Location_Table, Sample_Data_Table, and Chemical_Table. The attributes or data items needed for each table are shown below the table name. For example, the SWMUs Table requires eight attributes: Site_Name, Site_Description, Map, Operational History, Previous_Investigations, Site_Code, OU (operable unit), and Phase 1 Act. The data dictionary for the YPG project relational database, which provides definitions and specifications for the fields or attributes, is provided in the appendix.

Relationships between tables are shown by the lines connecting the tables. For example, the SWMUs Table is related to the Well_Table and the Sample_Data_Table through the Site_Code attribute. Data on every well in a SWMU can be found by conducting a query using the SWMU's Site_Code. Data on samples collected at a SWMU can be found in a similar manner. The type of relationship and cardinality constraint between tables are also shown in Figure 3.1. For example, because a SWMU can have many wells and many sampling events, the relationship between the

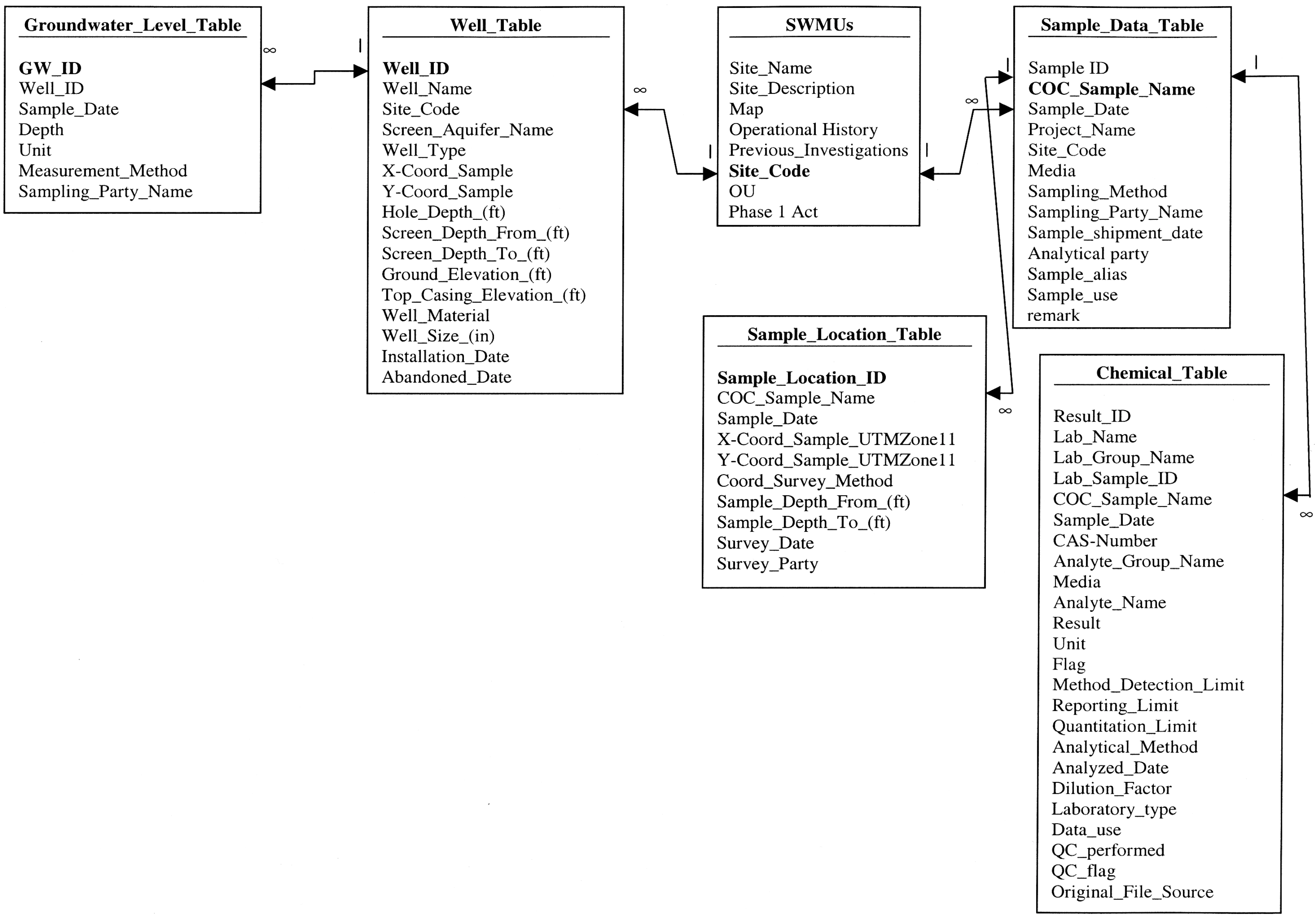

FIGURE 3.1 Diagram Showing Relationship of Tables in the YPG Project Relational Database

SWMUs Table and both the Well_Table and Sample_Data_Table is one to many (depicted as "∞"). This notation is used to show the relationship between all related tables.

Because not all analysts are proficient in using Microsoft Access, a procedure was established to allow data to be obtained in a timely and efficient manner while database integrity concerns are addressed. A database query interface was developed and placed on the project web sites (see Section 3.4.1 for details). Three queries are available: (1) soil risk assessment query (for data obtained after December 31, 1999), (2) soil risk assessment maximum results by site query (also for data obtained after December 31, 1999); and (3) custom query.

The soil risk assessment query allows the user to find contamination values by analyte at a specific site and sample depth. The soil risk assessment maximum results by site query allows the user to find the maximum values for each contaminant detected at a site. The custom query is displayed as a form, which the user completes to specify the appropriate criteria. The criteria can include site name, medium, laboratory name, analyte name, analyte group name, analytical method, sample date, or sample depth, among others. Results of the query can be either displayed on the user's screen or placed in a tab-delimited text file that the user can download and use in a spreadsheet or database application.

Most of the criteria specified by the user can be selected from drop-down boxes. The user can then choose the appropriate entry for those criteria in order to conduct the search. The choices in each of the boxes are developed by querying the YPG project relational database. Consequently, only entries present in the database for a specific field are listed in the drop-down box.

3.1.2 Entering Data into the YPG Project Relational Database

Certain teams or individuals will have primary responsibility for providing data for each of the six tables; the responsibilities are assigned as follows. The ANL Project Coordinator will be responsible for providing data for the SWMUs Table. Data will consist largely of text information describing the SWMU, such as its history, location, and results of previous environmental investigations. The Field Sampling Team members measuring groundwater levels will provide data for the Well_Table and Groundwater_Level_Table. They will record the data in their logbooks in accordance with SOPs 003 and 010 (Kimmell et al. 2000). The Field Sampling Team members doing surveys will provide data for the Sample_Location_Table from data recorded in their logbooks in accordance with SOP 003. The Field Sampling Team members will provide data for the Sample_Data_Table from entries recorded in their logbooks in accordance with SOPs 003 and 016 (Kimmell et al. 2000). The analytical laboratory will provide data for the Chemical_Table. The analytical laboratory will be free to provide electronic and hard-copy data in its own format, as long as all of the data for the Chemical_Table are provided along with documentation on how the data are formatted on the electronic file. All teams or individuals responsible for supplying data to the

YPG project relational database should refer to the appendix to this document for definitions and specifications of the fields required for all the tables in the database. The responsibilities and data sources for each table in the database are summarized in Table 3.1.

Because it is important to maintain database quality and integrity, data input will be controlled to prevent inadvertent modification or deletion of data. Original data provided by the aforementioned teams will be entered only by the Database Managers. Several quality assurance/quality control (QA/QC) checks will be performed by the Lead Database Manager before the data are entered. First, the data will be checked to be sure they are consistent with the COC form. Second, the data will be checked to be sure that the same data were not submitted earlier. Finally, the formats of the data entries from the analytical laboratory will be checked for their consistency with the formats of the YPG project relational database. If any problems are discovered, they can be corrected before the data are input into the database.

After the data have been input, several other quality checks of the YPG project relational database will be made. The data will first be checked for typographical errors and duplicate entries. Next, queries will be conducted to be sure that referential integrity is maintained after the new data have been added and to check for any missing data items.

TABLE 3.1 Data Responsibilities for Tables in the YPG Project Relational Database

Table in Database	Responsibility	Data Source[a]
SWMUs Table	ANL Project Coordinator	Historical information
Well_Table	Field Sampling Team (groundwater monitoring)	Logbooks, in accordance with SOPs 003 and 010
Groundwater_Level_Table	Field Sampling Team (groundwater monitoring)	Logbooks, in accordance with SOPs 003 and 010
Sample_Location_Table	Field Sampling Team (surveying)	Logbooks, in accordance with SOP 003
Sample_Data_Table	Field Sampling Team	Logbooks, in accordance with SOPs 003 and 016
Chemical_Table	Analytical laboratory	Lab chooses format, but must have data for all fields as specified in the appendix

[a] Source: Kimmell et al. (2000).

Backups of the database will be made on a regular basis. Every night, a tape backup will be made of any table that was changed during the day, and every month, a new backup of the entire database will be made. Consequently, recovery from any event that caused data to be lost or badly corrupted would be relatively easy.

3.2 VISUALIZATION TOOLS

Visualization tools will help the team view data in a spatial context and develop maps and diagrams for reports. These tools consist of a GIS, an Internet web site map, and a data browser, MaDCoW. The following sections describe each of these tools.

3.2.1 Geographic Information System Database

ARC/INFO software is the GIS standard for the project. The coordinate system used in the GIS is the Universal Transverse Mercator (UTM). This grid divides the world into 60 north-south zones, each covering a strip of six degrees, and each numbered consecutively from 1 to 60. YPG is located in zone 11. In each zone, coordinates are measured north and east in meters. “Northing” values are measured continuously from zero at the equator, in a northerly direction, and “southing” values are similarly measured south from the equator. A central meridian through the middle of each zone is assigned an easting value of 500,000 m. Grid values to the west of this central meridian are less than 500,000 m; to the east, they are more than 500,000 m.

Two types of data will go into the GIS: (1) spatial information, which describes the locations and shapes of geographic features and their spatial relationships to other features, and (2) descriptive information about the features. MaDCoW will use copies of data files from ARC/INFO that describe line or area features.

3.2.1.1 Using the GIS Database

Project team members will use the GIS to perform spatial analyses and draw maps and diagrams for project reports. Because many project team members are not proficient in using ARC/INFO, all requests to perform queries, draw maps or diagrams, or perform other spatial analyses will be discussed with and performed by the GIS Database Manager or a designee.

3.2.1.2 Entering Data into the GIS Database

Data entered into the GIS will also be controlled to maintain integrity. Data will be entered only by the GIS Database Manager or a designee upon approval from either the ANL Project Manager or ANL Project Coordinator. It will be the responsibility of the team member providing the GIS data to perform QA on the data he or she is providing. In some instances, features or coordinates on maps for the same site may not match; images may have become distorted because data were captured by different methods. In these instances, the GIS Database Manager will use a technique known as georeferencing to shift the maps so that the distortion is rectified and the features and coordinates correspond. If GIS data are updated with new information, the previous data will be archived in case those data are ever needed again. Furthermore, a backup of the complete GIS database will be made weekly. Consequently, recovery from any event that caused data to be lost or badly corrupted should be relatively easy.

A data dictionary will be developed as a reference during the project. This list will contain the name, description, and value for each attribute for each map layer.

Maps generated by the GIS will be organized according to SWMU and identified by means of a specific naming convention designed to track files. Each SWMU has a formal name and an acronym. Table 3.2 shows SWMU numbers, formal names, and acronyms. Files generated by the GIS will use an acronym as part of their name. For example, the first map in the series of maps for the Fuel Bladder Test Site will be named FBTS-01, the second map will be named FBTS-02, and so on. The base map for each SWMU will always be the first map (or -01) in the series. Consequently, each time the base map is changed, all maps that follow in the series and reference the base map will be redrawn with the updated map.

3.2.2 MaDCoW Browser

The second visualization tool is the MaDCoW browser. The program delivers maps and data quickly and easily over the Internet. MaDCoW is a pure Java program (an “applet”) that runs on a Java-enabled World Wide Web browser; it does not require browser plug-ins or other proprietary browser components. Project team members, the sponsor, and regulators will be able to easily visualize the site, thereby enhancing the users’ ability to perform analyses and monitor progress at the site.

3.2.2.1 Using the MaDCoW Browser

MaDCoW will help analysts and stakeholders visualize the site by displaying site features on a variety of interactive site maps. MaDCoW allows users to measure distances on the site map,

TABLE 3.2 Formal SWMU Name and Acronym

SWMU No.	Formal SWMU Name	SWMU Acronym
YPG–01	Old Chemical Laboratory at Building 2500	B2500
YPG–02	Chemical Waste Holding Tank near Building 2060	T2060
YPG–03	Leach Field near Building 2060	L2060
YPG–10	Fuel Bladder Test Site	FBTS
YPG–11	Pesticide Mix/Storage Facility At Building 430	PMSF
YPG–13a	Septic Tank/Sewage Lagoon at Castle Dome Heliport	CDSSL
YPG–13b	Wash Pad 1 (South) at Castle Dome Heliport	CDWP1
YPG–13c	Wash Pad 2 (North) at Castle Dome Heliport	CDWP2
YPG–13d	Basin at Castle Dome Heliport	CDWB
YPG–13e	Septic Tank/Leach Field (East) at Kofa Building 3490	KSLFE
YPG–13f	Septic Tank/Leach Field near Laguna Air Field and Building 3021	LSLF
YPG–23	Septic Tank/Leach Field (West) at Kofa Building 3490	KSLFW
YPG–25	Septic Tank/Leach Field (North) at Castle Dome Heliport	CDLFN
YPG–26	Septic Tank/Leach Field (South) at Castle Dome Heliport	CDLFS
YPG–31	West Environmental Test Area	WETA
YPG–32	Former Waste Disposal Area	FWDA
YPG–37	77th Explosive Ordnance Demolition Area	77EOD
YPG–43	Fire Training Pit	FTP
YPG–45	Building 506 UST (underground storage tank)	B506

view relationships between features, view only selected features, view tabular data associated with features, etc. Users can point and click on map features for information, pan or zoom to see regions at different scales, and select features to view data tables associated with that feature. Features may include roads, site boundaries, proposed and active monitoring wells, contours, and burial pits. Data tables may include information on geographic locations, physical characteristics of features, types and amounts of contaminants at a location, and soil/water cleanup goals.

Features are displayed in MaDCoW in layers; one layer shows roads, another shows monitoring wells, another shows contour lines, etc. Users can choose a single layer to view or superimpose multiple layers. Layers may also have tabular data associated with them; if they do, the data can be selected and displayed in tabular format. Users can develop and view tables of selected layers or features and selected attributes associated with those layers or features as well as any data in a linked table.

Data files used by MaDCoW will be a subset of those in either the YPG project relational database or GIS database. A MaDCoW view of each SWMU will be available via a hyperlink from the ERDE web site on the page describing the SWMU in detail. Project team members will tell the ANL Project Manager or ANL Project Coordinator the type of information they need displayed by MaDCoW. The appropriate files will then be made available to the MaDCoW program for viewing on the ERDE web site.

3.2.2.2 Entering Data into the MaDCoW Browser

The data used by MaDCoW to draw geographic features and display associated information will come from the YPG project relational database and GIS database. To maintain the integrity of both databases, MaDCoW will use a copy of the files. This practice will make it more difficult for data within either database to mistakenly get changed, but it will also make it important to update the MaDCoW data files as soon as changes are made to other database files. Backups of the files used by MaDCoW will be made on a weekly basis.

3.3 DOCUMENT RETRIEVAL CENTER

DRC at Argonne is a central repository for hard-copy data and electronic data on permanent storage media. Examples include documents, maps, databases (on CDs and floppy disks), and correspondence. The project team will use the DRC to maintain complete and accurate historical files and obtain data and documents in a convenient and efficient manner. These documents and data packages will become the official project record.

The DRC is located in Building 900, room F09, directly south of the Building 900 library. Bruce Verhaaren is the director of the DRC, and Janet Lyons is the clerk. The telephone number of the DRC is 630/252-4587.

A database of all data items pertaining to the YPG project will be maintained by the DRC staff. The database will contain each item's name, author, keyword(s), and other important attributes. The software used for the DRC database is Microsoft Access. Variable search capabilities will be available to project staff over the ERDE web site. Procedures for entering and searching for documents are described next in the following subsections.

3.3.1 Submitting Data to the DRC

Project team members will be able to log data items into the DRC by completing a form entitled "Yuma Proving Ground Project Document File." This form is available in the DRC on bright yellow paper. A sample is shown in Figure 3.2. When submitting a document or other data item to the DRC, the team member will not have to fill out Section I of the form. The DRC clerk can get that information directly from the title page of the item. However, the team member should complete Section II of the form, which requests information on document type, format, applicability to specific SWMUs, and keywords.

Yuma Proving Ground Project Document File

I. OPTIONAL: Please provide appropriate information not obvious from document.

DOCUMENT #: ____________________ *Published document number (if it has one).* **DATE:** ____________ *Publication Date.*

TITLE: ____

____

AUTHOR(S): ____

PREPARED BY: ____

PREPARED FOR: ____

II REQUIRED: (The following information is required)

DOCUMENT TYPE: (check one) ☐ **correspondence** ☐ **data report** ☐ **guidance** ☐ **map** ☐ **historical** ☐ **work plan** ☐ **other**______

DOCUMENT FORMAT: (circle one) **Hard Copy** **Computer File** **CD-ROM**

APPLICABLE SWMUS: (check all that apply)

☐ All
☐ None
☐ Old Chem. Lab./Bldg. 2500 (YPG-01)
☐ Chem. Waste Tank/Bldg. 2060 (YPG-02)
☐ Leach Field/Bldg. 2060 (YPG-03)
☐ Fuel Test Bladder Site (YPG-10)
☐ Pest. Mix/Storage-Bldg. 430 (YPG-11)
☐ Septic Tank/Sewage Lagoon (YPG-13a)
☐ Wash Pad 1 South (YPG-13b)
☐ Wash Pad 2 North (YPG-13c)
☐ Basin at Castle Dome (YPG-13d)
☐ Septic Tank/Leach Fld E-Bldg. 3490 (YPG-13e)
☐ Septic Tank at Laguna/ Bldg. 3021 (YPG-13f)
☐ Septic Tank/Leach Fld W-Bldg. 3490 (YPG-23)
☐ Septic Tank/Lch Fld North-Castle Dome (YPG-25)
☐ Septic Tank/Lch Fld South-Castle Dome (YPG-26)
☐ WETA (YPG-31)
☐ CTWDA (YPG-32)
☐ 77th Demo Area (YPG-37)
☐ Fire Training Pit (YPG-43)
☐ Bldg.506 UST (YPG-45)

KEYWORDS (Mark all appropriate boxes)

☐ ARAR
☐ aquifer
☐ biological agent
☐ CERCLA
☐ chemical warfare agent (CWA)
☐ compliance
☐ contamination
☐ decontamination equipment
☐ depleted uranium
☐ drinking water
☐ ecology
☐ ecotoxicology
☐ field test
☐ geochemistry
☐ geology
☐ geophysical
☐ groundwater
☐ habitat
☐ human health
☐ hydrology
☐ ingestion
☐ leach field
☐ metals
☐ migration
☐ modeling
☐ munitions
☐ NEPA
☐ organics
☐ pathway
☐ PCB
☐ pesticides
☐ preliminary assessment (PA)
☐ protective equipment
☐ radioactivity
☐ RCRA
☐ receptors
☐ regulations
☐ remediation
☐ risk
☐ sampling
☐ saturated zone
☐ sewage disposal
☐ soil
☐ soil gas
☐ solidwaste management unit (SWMU)
☐ subsurface soil
☐ surface water
☐ SVOC
☐ underground storage tank (UST)
☐ unexploded ordnance (UXO)
☐ vadose zone
☐ vegetation
☐ VOC
☐ waste
☐ wells
☐ wildlife

(Use lines for additional keywords not listed above.)

DRC Use Only

YU#: ____________ **DATE ENTERED:** ____________

RIDS: ____________ **INITIALS:** ____________

RETENTION: ____________ **DATE CHECKED:** ____________

ACCESS LIMITATIONS: ____________ **INITIALS:** ____________

FIGURE 3.2 Form for Logging Data into the Document Retrieval Center

Some project staff members may have documents or other data items in their possession or may receive items that they will need to keep in their offices for the duration of the project. They should still log these items into the system. The item will not have to leave the team member's office as long as both Sections I and II of the form have been completed and the form has been submitted (along with a photocopy of the data item's title) to the DRC clerk with a note on where the data item is located. The clerk will make a note in the database that the data item has been checked out so others will know of the item's existence and be able to use it.

"Important correspondence" should also be submitted to and archived in the DRC. Important correspondence refers to letters, faxes, e-mails, telephone conversations, etc., with regulators, such as the U.S. Environmental Protection Agency (EPA) or the Arizona Department of Environmental Quality, or discussions with the sponsor that affect the scope or deliverables as defined in the original work scope. Routine correspondence need not be sent to the DRC. If questions arise about what constitutes "important correspondence," the Data Management Officer (DMO), ANL Project Manager, or ANL Project Coordinator should be contacted.

To keep track of project-related e-mail, a YPG project mailbox was established. The address of the mailbox is ypg@anl.gov. When important e-mail correspondence is sent to team members, a copy should be sent to the YPG project mailbox. All Argonne project team members will be able to access and view e-mail in the mailbox, but only administrative staff will be authorized to delete mail.

3.3.2 Searching for Data in the DRC and Retrieving Them

A search engine has been developed to allow project staff to search the database for data items needed for their work. The search engine can be accessed by project staff from the ERDE web site. The project web site is discussed in Section 3.4. Project staff can search the database by title, author, document type, SWMU, and keyword. DRC data used for the search are updated weekly.

After a project staff member finds a needed document to check out, he or she can call or visit the DRC, and DRC staff will retrieve it. The project staff member will complete a form with his or her name, location, the title of the document, and current date. This form will be filed in place of the original item. The DRC staff will then know who has the document in case another colleague requests it. When the project staff member is finished with the document, he or she can simply return it to the DRC.

3.4 INTERNET WEB SITES

Two internet web sites have been developed for this project. The ERDE web site is for government regulators, sponsors, and technical staff. The second web site, known as Environmental Restoration at Yuma Proving Ground, is for stakeholders and the general public. The purpose of the web sites is to facilitate communication among government regulators, sponsors, and technical staff and to facilitate public participation with interested stakeholders. The objectives are to (1) speed decision-making and foster information sharing and feedback among all team members, (2) keep all project management staff apprised of progress, (3) function as an information repository for regulators, and (4) provide a mechanism for sharing information between stakeholders and the YPG team.

3.4.1 Environmental Restoration Data Exchange Web Site

The Internet address of the ERDE web site is http://web.ead.anl.gov/ypg. A user name and password are needed to enter the site. There are two passwords for the protected portion of the web site. One is an administrative password to allow changes and additions to the data on the web site. It can be used by the ANL Project Manager, ANL Project Coordinator, Project Webmaster, and Database Managers. The second password is for the other members of the project team who will need to use the information, but not change or add to it. If staff members do not know the user name or password, they should contact the DMO, ANL Project Manager, or ANL Project Coordinator.

3.4.1.1 Contents of ERDE

The ERDE web site contains a great deal of information that will be useful to team members, sponsors, and regulators. The web site home page shows general background information on the YPG site as well as on the remediation project. It shows current weather at YPG and has a hyperlink to the 5-day weather forecast. The viewer can make a number of choices from the main menu. The following list provides a brief overview of each section that can be chosen:

- *What's New* describes new additions to the web site and the date they were added. If one has never visited the web site or has not visited it for a long time, this is the best place to begin.

- *Background* provides a detailed overview of YPG's history. It has hyperlinks to the U.S. Army's YPG web site and to the web sites of the two regulators (i.e., the EPA and ADEQ).

- *Data* is the entry point for the YPG project relational database query interface. There are three types of queries available: soil risk assessment query, soil risk assessment maximum results by site query, and custom query. The custom query is displayed as a form, which the user completes to specify the criteria for the query. The user can specify criteria such as site name, media, lab name, analyte name, analyte group name, analytical method, sample date, or sample depth.

- *Schedule* shows information on events and other project-related activities for the current month. A brief description of an event/activity is shown on the date it occurs, and a hyperlink leads to a more detailed description of the event/activity and the name and telephone number of the contact person. Similar information is shown for past and future months.

- *Documents* lists all documents available on the ERDE web site. The table of documents provides document descriptions, document categories (comment/ response, work plan, database, misc.), document dates, and status. There are hyperlinks to the documents themselves. The form used to search for documents in the DRC is located on this page.

- *Image Gallery* displays pictures and maps that are available to view. Images are selected by searching the picture archive. A search is performed by specifying a category, SWMU, and keyword.

- *SWMU* shows a YPG site map with the locations of all SWMUs and groups them into operable units. Hyperlinks on the site map connect the user to more detailed information on each SWMU, including its description, history, and previous investigations, if any. Thumbnail views of pictures, with hyperlinks to a full screen view and a hyperlink to the MaDCoW view of the SWMU, are shown on the page of detailed information on each SWMU.

- *Personnel* is a table of the names of people involved in the project. It includes Argonne team members, the U.S. Army sponsors, and regulators. Each individual's organization, project role, telephone and fax numbers, and e-mail address is listed.

- *Feedback* is a screen that allows a user to submit questions and comments to the project team and list his or her name and e-mail address to get a response.

- *Disclaimer* is a screen showing standard legal disclaimer information.

3.4.1.2 Editing and Posting Information on ERDE

As noted earlier, only the ANL Project Manager, ANL Project Coordinator, Project Webmaster, and Database Managers are authorized to make changes or additions to the web site. Any requests for changes or additions to the web site should be directed to one of these administrators. Because the ERDE web site is protected by a password and cannot be accessed by the general public, documents that are posted on it do not require clearance.

3.4.2 Environmental Restoration at Yuma Proving Ground Web Site

The Internet address of this site is http://web.ead.anl.gov/yuma. Because this is a public web site, no password is required.

3.4.2.1 Contents of the Public Web Site

This web site has some of the same features as those of the ERDE. A *What's New* section describes new additions to the site and tells when they were added. Other sections have descriptions and maps of the SWMUs, links to publicly available project documents, meeting announcements, and the name and address of a contact person for feedback via e-mail.

3.4.2.2 Editing and Posting Information on the Public Web Site

Similar to the ERDE web site, only the ANL Project Manager, ANL Project Coordinator, Project Webmaster, and Database Managers are authorized to make changes or additions to the web site. Any requests for changes or additions to this web site should be directed to one of these administrators.

Because this web site is public, documents need to be cleared before they can be posted on it. The following steps are required to clear a document:

- Technical review by at least one person not involved in authoring the document or the section(s) of the document being reviewed. More than one reviewer may be necessary if different areas of technical expertise are required to conduct an effective review.

- Editorial review conducted by an Argonne editor. The editorial review should follow the technical review.

- Completion of ANL Form 330 and submission of the form and two copies of the document to Argonne's Information and Publishing Division, Publications and Record Services. Under normal circumstances, clearance can be obtained in 5 to 7 days. Clearance can be obtained faster (1 to 3 days) if the paperwork is "walked through" the process.

Correspondence, such as letters, must also be cleared to be posted on the public web site, but they do not need to be edited.

3.5 ENVIRONMENTAL RESTORATION INFORMATION SYSTEM

At some time in the future, data collected during the course of the YPG project will also be transferred to ERIS. ERIS will replace the environmental restoration database system used by the U.S. Army known as the Installation Restoration Data Management Information System (IRDMIS). ERIS is still under development, and there is currently no schedule for data transfer.

3.5.1 Contents of ERIS

ERIS will be an interactive, easy-to-use database on the World Wide Web. It will have a standard data format and provide the Army with a single source for field restoration data. Some of the significant beneficial features of ERIS will include these: (1) data sharing across Army installations and major commands; (2) integration with commercial, off-the-shelf applications, such as ArcView, Earth Vision, and Microsoft Office Products; (3) password protection for multitiered security; (4) consistent and accurate reporting on installation restoration sites and projects; and (5) quickly accessible data to facilitate better decision making.

3.5.2 Transferring Data to ERIS

There is currently no schedule for transferring data to ERIS; it will be determined from discussions with the AEC once ERIS is operational. Chemical, geological, geographic, and remedial action data will be entered either through data entry screens on the Web site or through a file upload capability. A Defense Environmental Network and Information Exchange (DENIX) account will be required to enter data.

The DMO will be responsible for obtaining the DENIX account and ensuring that data are transferred to ERIS in an efficient and timely manner. To make data transfer to ERIS as seamless as possible, formats for data used in the YPG project relational database will follow the ERIS data dictionary as closely as possible.

4 PROJECT AND DATA MANAGEMENT RESPONSIBILITIES AND INTERACTIONS

4.1 PROJECT ORGANIZATION

Figure 4.1 is an organization chart showing the lines of authority and communication among the organizations involved in this project. The YPG Program Manager, Chuck Botdorf, has overall authority for the project and is the primary decision maker. He has direct authority over Argonne staff and YPG subcontractors involved in sampling and analysis, and he communicates with the U.S. Army DTC, which has technical and fiscal oversight, and with ADEQ, which has regulatory oversight.

The ANL Program Manager, Jack Ditmars, reports to the YPG Program Manager. Reporting directly to the ANL Program Manager are the ANL QAO, Todd Kimmell; the ANL Project Manager, Lou Martino; and the ANL Health and Safety Officer, also Lou Martino. The ANL Project Manager has line authority over the ANL Contracting Officer and over the ANL Project Coordinator Terri Patton. Regular communications will take place between the ANL Project Manager and the YPG contractors. The ANL Contracting Officer is responsible for bringing contractors into the Argonne team as special skills are required for the project.

The ANL Project Coordinator is responsible for coordinating day-to-day project work performed at Argonne's Chicago area office and for facilitating communication among all project components as well as for coordinating this work with contractors in the field. She has line authority over the Data Management Team, RI Team, BRA Team, and FS Team. (Individuals may participate on more than one team.)

4.2 DATA MANAGEMENT ROLES AND RESPONSIBILITIES

The following sections list the project staff members and their data management responsibilities. Table 4.1 provides a list of data management personnel and information on how to contact them. This information is also available through the ERDE web site. The YPG Program Manager and ANL Project Manager are also listed on the public web site.

4.2.1 YPG Program Manager

The YPG Program Manager (Chuck Botdorf, YPG) is responsible for overseeing all management and technical activities of the YPG RI/FS project. As part of this function, he facilitates the transfer of data from YPG to project contractors.

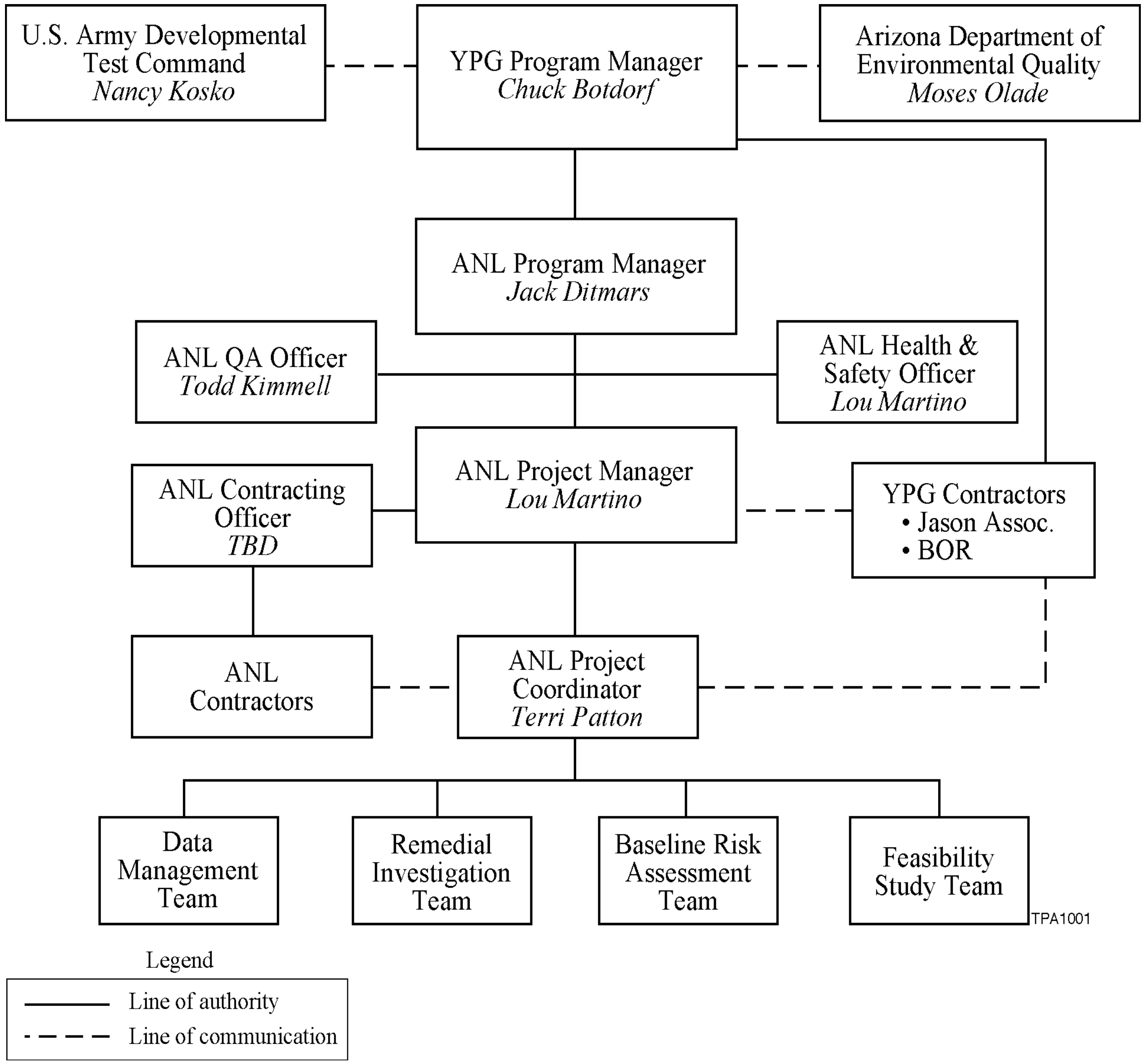

FIGURE 4.1 Project Organization Chart Showing Lines of Authority and Communication

TABLE 4.1 Data Management Personnel

Project Role	Contact	Phone No.	E-Mail
ANL Project Manager	Lou Martino (ANL)	202/488-2422	martinol@anl.gov
ANL Project Coordinator	Terri Patton (ANL)	630/252-3294	tlpatton@anl.gov
ANL Quality Assurance Officer	Todd Kimmell (ANL)	301/515-7134	kimmellt@anl.gov
Data Management Officer	Les Poch (ANL)	630/252-8129	lapoch@anl.gov
Database Managers	Andy Huttenga (ANL) Ron Yuen, lead (ANL)	630/252-3613 630/252-4869	huttenga@anl.gov yuenr@anl.gov
GIS Database Manager	Kurt Roloff (ANL)	630/252-6785	roloff@anl.gov
Project Webmaster	Pam Richmond (ANL)	630/252-7207	pdrichmond@anl.gov
Human Health and Ecological Risk Assessment Team Leaders	Jim Butler (ANL) Ihor Hlohowskyj (ANL)	630/252-9158 630/252-3478	jpbutler@anl.gov hlohowskyj@anl.gov
Field Sampling Team Leaders	Lou Martino (ANL) Bill Davies (ANL) Bruce Goff (Jason)	202/488-2422 630/252-6224 520/328-3916	martinol@anl.gov wdavies@anl.gov bgoff@jason.com

4.2.2 ANL Project Manager

The ANL Project Manager (Lou Martino, ANL) is responsible for the overall management and technical direction of the YPG RI/FS project. Specific responsibilities include these:

- Controlling the Argonne project budget,
- Directing all project planning activities,
- Updating the ERDE and public web sites as needed,
- Preparing project status reports,
- Reviewing and approving changes to field work,

- Reviewing incoming field notations and laboratory reports for completeness,

- Reviewing and approving all project memoranda and reports, and

- Serving as a point of contact for all data requests from non-Argonne contractors.

4.2.3 ANL Project Coordinator

The ANL Project Coordinator (Terri Patton, ANL) assists the ANL Project Manager in coordinating project activities within Argonne and facilitating communication among all project team members. Specific responsibilities include these:

- Distributing relevant information to all project team members,

- Reviewing incoming COC forms,

- Updating the ERDE and public web sites as needed,

- Preparing memorandums and coordinating project reports,

- Clearing project documents for distribution, and

- Serving as a point of contact for Argonne project team members.

4.2.4 ANL Quality Assurance Officer

The ANL QAO (Todd Kimmell, ANL) reviews project sampling and analysis activities to ensure that the data obtained are of sufficient quality to support project decisions. Specific responsibilities include:

- Preparing the QAPP,

- Developing data quality objectives (DQOs),

- Conducting laboratory performance evaluations,

- Conducting laboratory and field audits,

- Conducting field readiness reviews,
- Reviewing and validating field and analytical data, and
- Documenting the results of all audits and reviews.

4.2.5 Data Management Officer

The DMO (Les Poch, ANL) oversees all data management activities to ensure the timely and efficient transfer of data among users. Specific responsibilities include these:

- Preparing the DMP,
- Providing informal data management instructions to the project team,
- Monitoring data transfers to ensure data management protocols are followed, and
- Reporting problems in data transfer to the ANL Project Manager and proposing solutions.

4.2.6 Database Managers

The Database Managers (Ron Yuen [lead] and Andy Huttenga, both of ANL) create and maintain the YPG project relational database. Specific responsibilities include these:

- Preparing QA/QC procedures for database management,
- Constructing the YPG project relational database,
- Overseeing all data entry (both electronic and hard-copy formats),
- Monitoring data entry to ensure data QA/QC protocols are followed,
- Assisting project team members with database queries, and
- Reporting database errors and omissions to the ANL Project Manager.

4.2.7 GIS Database Manager

The GIS Database Manager (Kurt Roloff, ANL) creates and maintains the YPG project GIS database and MaDCoW files on the basis of data subsets extracted from the YPG project relational database. Specific responsibilities include these:

- Preparing QA/QC procedures for managing the map database,
- Preparing maps and maintaining map files as needed by the YPG project team,
- Providing input regarding GPS sampling points, and
- Reporting database errors and omissions to the ANL Project Manager.

4.2.8 Project Webmaster

The Project Webmaster (Pam Richmond, ANL) designs, creates, and maintains the ERDE and public web sites. Specific responsibilities include these:

- Revising the ERDE and public web sites as needed to keep pace with project needs,
- Uploading images in the image gallery,
- Serving as a point of contact and troubleshooter for any problems associated with using the ERDE and public web sites.

4.2.9 Project Teams

The project teams consist of personnel involved in the RI portion of the YPG project. (Teams involved in the FS portion will be designated later.) In addition to their specific project responsibilities, all project team members are expected to report any errors (or suspicion of errors) associated with the collection or management of project data to the ANL Project Manager and DMO. Each project team member is responsible for performing QA/QC checks for all the data he or she submits.

4.2.9.1 Human Health and Ecological Risk Assessment Team

The Human Health and Ecological Risk Assessment Team Leaders (Jim Butler and Ihor Hlohowskyj, both of ANL) perform risk evaluations on the basis of data collected in Phase 1 and 2 of the RI. Specific responsibilities include these:

- Compiling regulatory guidelines for soil and groundwater,
- Conducting the preliminary risk screening and final risk evaluation, and
- Developing and updating screening criteria, as needed.

4.2.9.2 Field Sampling Team

Leaders. The Field Sampling Team Leaders (Lou Martino and Bill Davies, both of ANL; Bruce Goff, Jason Associates Corporation) coordinate the implementation of the FSP and oversee field activities, including field measurements, sample collection, and field documentation. Specific responsibilities include these:

- Ensuring that field documentation is completed and copies are sent to the ANL Project Coordinator;
- Documenting deviations from the FSPs,
- Reporting map errors to the ANL Project Manager and GIS Manager,
- Collecting field documentation (e.g., field notes, readiness review forms) after each sampling event, and
- Tracking the status of samples through the data life cycle.

Members. Field Sampling Team members consist of any contractor personnel who participate in field activities, including field measurements, sample collection, and field documentation. In addition to their specific project responsibilities, Field Sampling Team members are expected to report any errors (or suspicion of errors) associated with the collection or management of project data to the ANL Project Manager and DMO. Each Field Sampling Team member is responsible for performing QA/QC checks for all the data he or she submits.

4.2.10 Analytical Laboratory

The analytical laboratory staff members perform chemical analyses, sign the COC form, and provide analytical results to the ANL Project Manager in a format consistent with the YPG project relational database (see the appendix). The analytical laboratory is responsible for ensuring that its QA/QC protocols have been followed before submitting its data to Argonne.

4.3 DATA MANAGEMENT INTERACTIONS

Figure 4.2 shows the basic data flowchart for the project. All data will be stored in either the DRC or the YPG project relational database or in both places. Data stored in the DRC will be in hard-copy format (e.g., reports and maps), in a permanent storage medium (e.g., CDs), or in an e-mail archive. After the data are logged into the DRC, they will be searchable from the ERDE web site. Data stored in the YPG project relational database will be data that were originally in electronic format and data that are needed to populate the fields in the database tables. The YPG project relational database will be used to perform analyses for project deliverables and to supply data for use in visualization tools and the two web sites. The web sites will allow access to varying amounts of information, depending on the password level. The ERDE web site will require different passwords for project administrative staff and project technical staff. The public web site will contain publicly available information and therefore will not be password-protected. Figure 4.3 shows a more detailed flowchart for each type of data. The figure tracks data flow from the source, to processing or analysis, to validation/verification/approval, and then to storage.

Historical documentation will be collected by various team members throughout the course of the project, but most of it will be collected in the early stages. The ANL Project Manager will help team members gain access to historical documentation that may be available only at the site or that may require the approval of the U.S. Army to obtain. The DMO has developed a system for logging documents into the DRC and for ensuring that when a document is checked out by a team member, its location is known. This system ensures document availability. Documents entered into the DRC database can be searched by using a query form available on the ERDE web site.

Federal and State of Arizona regulatory standards will be collected and analyzed by the risk assessment leads, who will develop human health and ecological risk screening values. The risk screening values will be forwarded to one of the Database Managers, who will input them into the YPG project relational database.

Field measurements and field notes generated by the field sampling and survey teams will be collected by the Field Team Leaders. They will log in the field notes, review the entries for completeness, perform QA/QC procedures, resolve any issues, and give the field notes

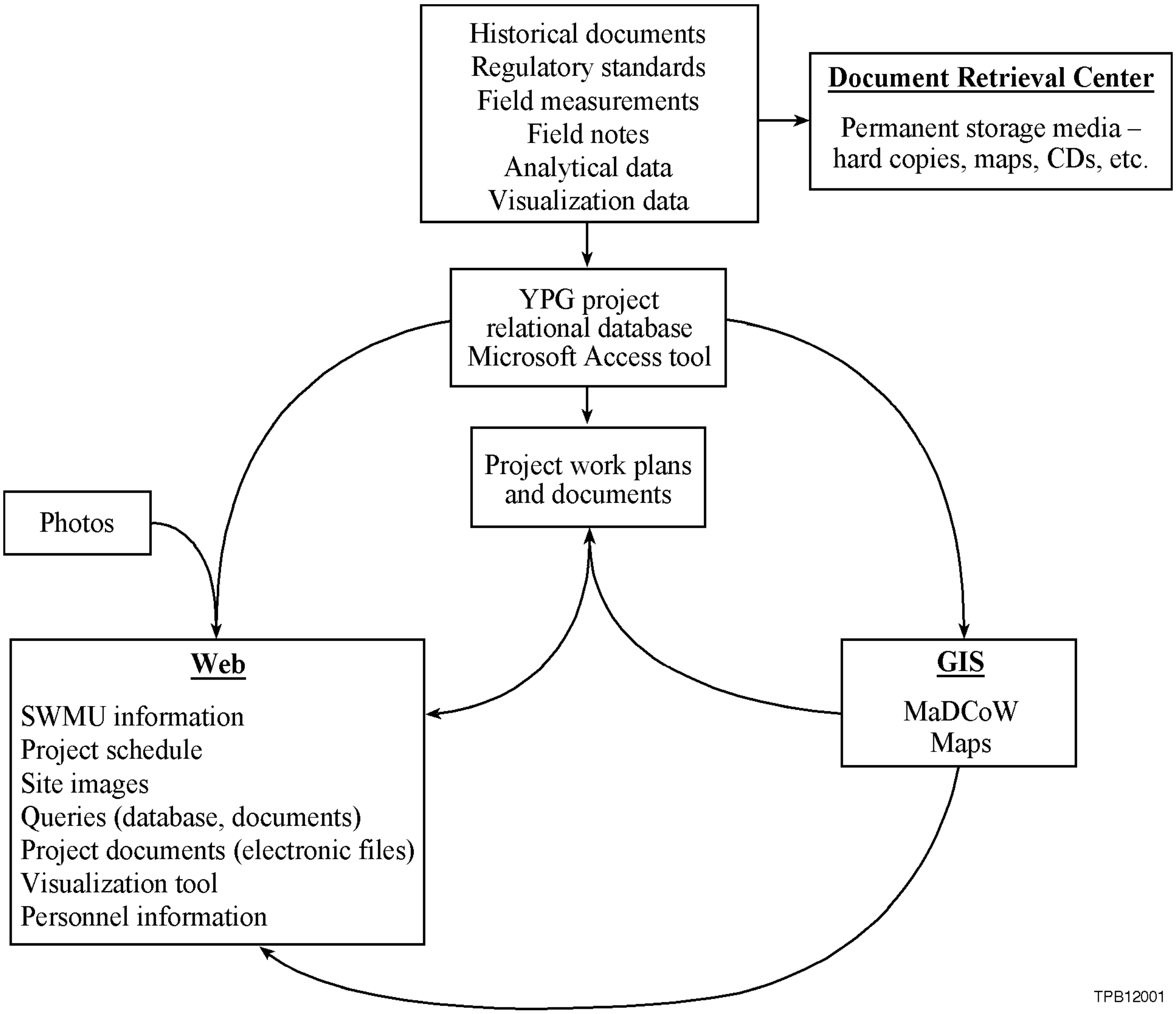

FIGURE 4.2 Basic Project Data Flow

to a Database Manager for entry into the database. The ANL Project Coordinator will then arrange for the logbooks to be catalogued and stored in the DRC. If sampling was performed by the field teams, they will send a copy of the COC forms to the Lead Database Manager. The Lead Database Manager will maintain a database to track the status of the samples as they proceed through the analysis process. This tracking system will enable the project management team to discover any discrepancies in the sampling and analysis chain and take steps to correct them. Pertinent information, such as COC numbers, names of samples on COC forms, dates that the samples were sent to the laboratory, names of analytical laboratories, and dates the laboratory received the samples, will be put into the database.

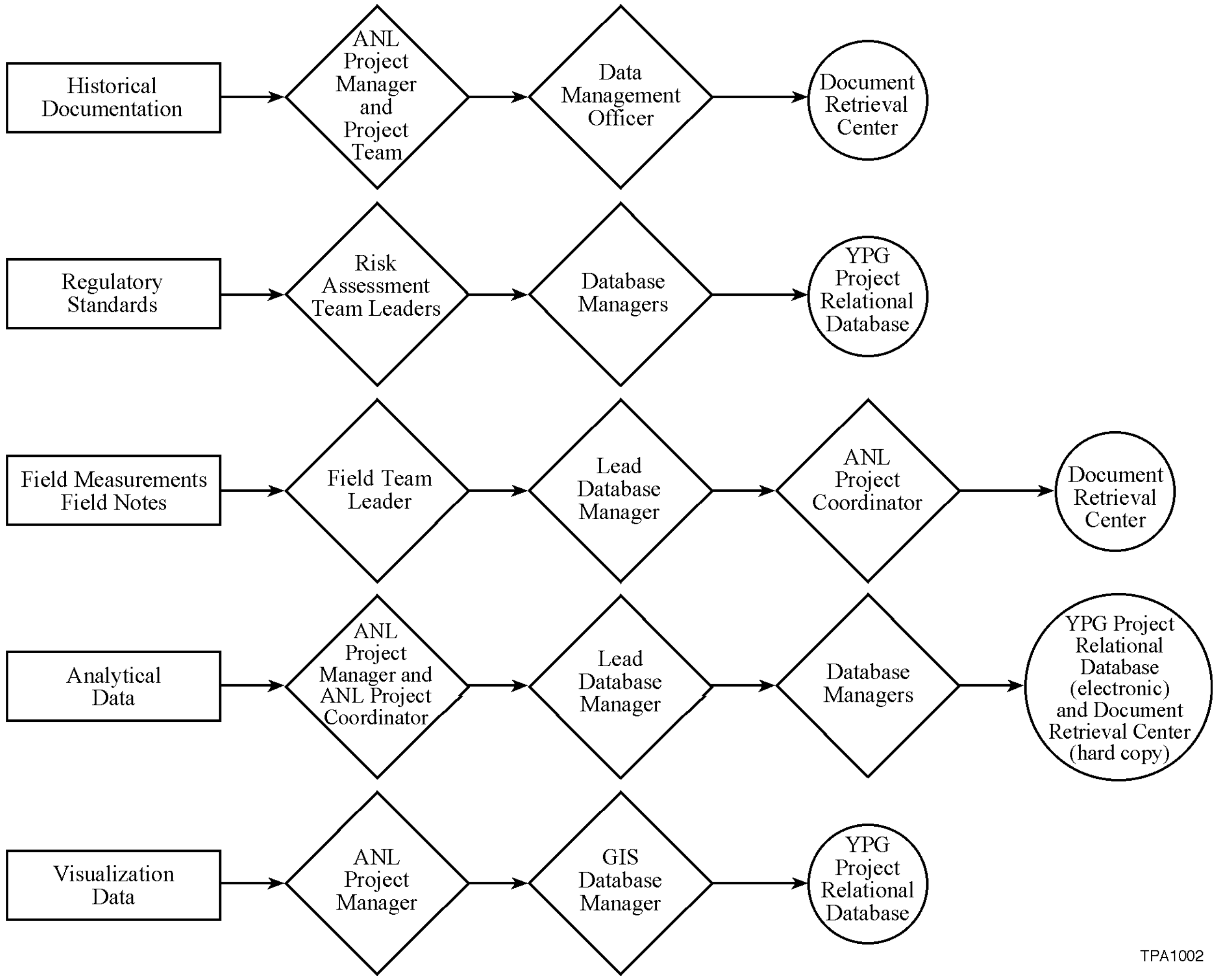

FIGURE 4.3 Detailed Data Flow by Data Type

Analytical data will be supplied by the laboratory performing the analyses in both hard-copy and electronic format. The analytical laboratory is free to provide electronic and hard-copy data in its own format, as long as all of the data for the chemical table are provided along with documentation on the data format and location. The appendix lists the data for which the analytical laboratory is responsible. The Lead Database Manager will review the documentation for completeness and perform QA/QC procedures on the data as described in Section 3.1.2. One of the Database Managers will then enter the data into the database.

A YPG e-mail mailbox was established to archive all project-related e-mails from Argonne, the sponsor, regulators, and other contractors. All Argonne staff members can read e-mail in the project mailbox, but only several members of administrative staff have permission to delete e-mail. When Argonne project staff members send project-related e-mail to each other or to non-ANL project team members, the YPG project mailbox should be a recipient also. The address of the mailbox is ypg@anl.gov.

5 REFERENCES

American Society for Quality Control (ASQC), 1994, *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*, ANSI/ASQC E4-1994.

Byrd, W.P., no date, *Developing, Implementing, and Maintaining Data Management Implementation Plans*, Bechtel Jacobs Company, LLC, BJC-ES-03, Rev. No. 1.

Hocking, E., 2000, *Community Involvement Plan for the Yuma Proving Ground Installation Restoration Program,* prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Army, Yuma Proving Ground, Ariz.

Kimmell, T., et al., 2000, *Remedial Investigation Sampling and Analysis Plan for Selected Sites at Yuma Proving Ground, Arizona, Volume 2: Quality Assurance Project Plan*, ANL/EAD/TM-96, prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Army, Yuma Proving Ground, Ariz.

Martino, L.E., et al., 2000, *Remedial Investigation Sampling and Analysis Plan for Selected Sites at Yuma Proving Ground, Arizona, Volume 1: Field Sampling Plan*, ANL/EAD/TM-95, prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Army, Yuma Proving Ground, Ariz.

McFadden, F.R., et al., 1999, *Modern Database Management (Fifth Edition),* Addison-Wesley.

Patton, T., et al., 2001, *Remedial Investigation/Feasibility Study Work Plan for Selected Sites at Yuma Proving Ground, Arizona,* ANL/EAD/TM-102, prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Army, Yuma Proving Ground, Ariz.

6 LIST OF PREPARERS

This DMP was prepared for the Environmental Sciences Division of YPG's Command Technology Directorate by staff in Argonne's Environmental Assessment Division. The following Argonne staff members contributed to the preparation of this report.

Name	Educational Experience	Contribution
Les Poch	M.S., nuclear engineering, 21 years experience in energy and environmental systems analysis and engineering, lead author	Sections 1 through 6; Appendix
Terri Patton	M.S., geology, 15 years experience in environmental research and assessment	Sections 2 and 4
Cheong-Yip Yuen	Ph.D., geology (hydrogeology and environmental geology); 11 years experience in hydrogeological analysis; 17 years experience in process geomorphology	Sections 2 and 3; Appendix

APPENDIX:

TABLES AND ATTRIBUTES IN THE YPG PROJECT RELATIONAL DATABASE

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TABLES AND ATTRIBUTES IN THE YPG PROJECT RELATIONAL DATABASE

This appendix describes the tables that make up the YPG project relational database. A brief description of each table and its relationship to other tables in the database is provided here. Attributes in each table are described by name, type, and size of data field. An example of a typical data item is given, if necessary, for clarification.

A.1 SWMUs Table

The table on solid waste management units (SWMUs) describes each SWMU at YPG. It is linked to both the Well_Table and Sample_Data_Table by a one-to-many relationship. There are eight fields in this table:

1. Site_Name: The full name given to a SWMU. It is a text field of up to 120 characters. An example of a site name is Fuel Bladder Test Site.

2. Site_Description: A brief narrative about the SWMU, covering its location within YPG and areas or facilities of actual or potential environmental concern. It is a memo field of unlimited length.

3. Map: The path name of the location for a site photograph or map. It is a text field of up to 50 characters.

4. Operational_History: A brief narrative of the history of the SWMU, listing the types of activities performed there and the dates those activities were performed. It is a memo field of unlimited length.

5. Previous_Investigations: A brief narrative about the types of environmental investigations previously performed and when they were performed. It is a memo field of unlimited length.

6. Site_Code: The acronym given to a SWMU. It is a text field of up to 10 characters. An example is FBTS, which is the acronym for Fuel Bladder Test Site. (A complete list of acronyms is shown in Table 3.2.) It is a text field of up to 10 characters and the primary key of this table.

7. OU: The number given to an operable unit. An operable unit can be made up of two or more SWMUs. The project has been divided into four OUs. This is a number field of up to 4 characters.

8. Phase 1 Act: A brief narrative of the activities performed during Phase 1 of the RI/FS. This is a memo field of unlimited length.

A.2 Chemical_Table

This table lists the results of the chemical analyses performed on every sample. The data in this table are supplied by the analytical laboratory. The table is linked to the Sample_Data_Table by a many-to-one relationship. There are 24 fields in this table.

1. Result_ID: A unique number assigned by one of the Database Managers to each data record in this table to provide correct linkages between tables. It is a number field of up to 4 characters and the primary key of this table.

2. Lab_Name: The name of the analytical laboratory performing the chemical analysis. It is a text field of up to 50 characters.

3. Lab_Group_Name: The name of the batch in which the sample was processed by the laboratory. It is a text field of up to 50 characters.

4. Lab_Sample_ID: A unique number assigned by the analytical laboratory to the results of a specific chemical analysis performed on a sample. It is a text field of up to 50 characters.

5. COC_Sample_Name: A chain-of-custody name assigned to the sample in the field by the team taking the sample. It is a text field of up to 50 characters and a foreign key in this table.

6. Sample_Date: The date the field sample was taken. It is a date/time field of 8 characters, but shows only the date.

7. CAS-Number: A standard number assigned by the Chemical Abstracts Service to the chemical analyte of interest. It is a text field of up to 50 characters.

8. Analyte_Group_Name: The group to which a specific chemical analyte belongs. It is a text field of up to 50 characters. Examples include metals,

TPH (total petroleum hydrocarbons), and VOCs (volatile organic compounds).

9. Media: The medium sampled. It is a text field of up to 50 characters. Examples are surface soil (samples taken on the surface, just underneath the vegetative mat), subsurface soil (samples taken up to 2 ft below the surface), groundwater, surface water, and sediment.

10. Analyte_Name: The name of the chemical for which the sample was analyzed.

11. Result: The numerical outcome of the method used to analyze the chemical of interest. A result that is less than the method detection limit is displayed as "(method detection limit value)" and the notation "ND" is used in the "Flag" field. It is a number field of 8 characters.

12. Unit: The standard term used as a measure of the result. It is a text field of up to 25 characters.

13. Flag: A identifier provided by the analytical laboratory to qualify the result. For example, if an analyte concentration is below the method detection limit, the notation "ND" is used. It is a text field of up to 50 characters.

14. Method_Detection_Limit: The lowest concentration of a substance that can be measured with 99% confidence that the analyte concentration is greater than zero. It is a number field of 8 characters.

15. Reporting_Limit: The lowest concentration that is reported. It applies to all regulated analytes. It is a number field of 8 characters.

16. Quantitative_Limit: The lowest level at which a chemical may be accurately and reproducibly quantified. It is usually equal to the detection limit multiplied by a factor of 3 to 5, but it varies among chemicals and among samples. It is a number field of 8 characters.

17. Analytical_Method: The name of the procedure used to perform the analysis. It is a text field of up to 50 characters.

18. Analyzed_Date. The date the sample was analyzed for the analyte of interest. It is a date/time field of 8 characters, but it shows only the date.

19. Dilution_Factor. The factor by which the sample was diluted with water to reduce the concentration of the chemical contaminant so it could be detected by the method used in the analysis. It is a number field of 8 characters.

20. Laboratory_type: The type of laboratory performing the analysis. Examples include field laboratory and state certified laboratory. It is a text field of up to 20 characters.

21. Data_use: Indication of whether the analytical laboratory added a surrogate chemical to this sample as a quality control (QC) test. If a surrogate chemical was used, this field has an "S," the Analyte_Name field contains the chemical surrogate name, and the Result field has the numerical value of the chemical concentration. It is a text field of up to 20 characters.

22. QC_performed: Indication of whether an internal or external QC process was performed. The field contains either a "Yes" or "No." It is a text field of up to 50 characters.

23. QC_Flag: Further qualification of the result of the QC evaluation as indicated by a coded flag. It is a text field of up to 50 characters.

24. Original_File_Source: The name of the file from the analytical laboratory that contained the result. It is a text field of up to 72 characters.

A.3 Groundwater_Level_Table

This table shows data on the groundwater level every time a groundwater sample is taken from a well. The data are obtained by the field sampling team. The table is linked to the Well_Table by a many-to-one relationship. There are seven fields in this table:

1. GW_ID: A unique number assigned by one of the Database Managers to each data record in this table to provide correct linkages between tables. It is a number field of 4 characters and the primary key of this table.

2. Well_ID: The unique data record identifier from the Well_Table used to provide correct linkages between tables. It is a number field of 4 characters and a foreign key in this table.

3. Sample_Date: The date and time the groundwater level sample was taken. It is a date/time field of 8 characters, but it shows only the date.

4. Depth: The distance of the groundwater from the reference point on the top of the well casing. This is a number field of 8 characters.

5. Unit: The standard term used as a measure of the depth, such as feet or meters. It is a text field of up to 50 characters.

6. Measurement_Method: The method used to measure the groundwater level. Some possible methods are interface probe, electronic water level detector, weighted steel tape, and transducers and dataloggers. It is a text field of up to 50 characters.

7. Sampling_Party_Name: The name of the organization and the name of the person taking the sample. It is a text field of up to 50 characters.

A.4 Sample_Data_Table

This table shows information on samples taken by the field sampling teams. It has data on the chain-of-custody (COC) sample name, site and type of medium sampled, sampling method, sampling date, and sampling party. The table is linked to both the Sample_Location_Table and Chemical_Table by a one-to-many relationship. There are 13 fields in this table:

1. Sample_ID: A unique identifier developed by one of the Database Managers to enhance database performance. It is a number field of 4 characters.

2. COC_Sample_Name: A name assigned to the sample in the field by the team taking the sample. It is a text field of up to 50 characters and one component of the composite key of this table.

3. Sample_Date: The date and time the sample was taken. It is one component of the composite key of this table. It is a date/time field of 8 characters, but it shows only the date.

4. Project_Name: A name assigned by the field sampling team. It is a text field of up to 50 characters.

5. Site_Code: An acronym given to the SWMU. An example is FBTS, which is the acronym for Fuel Bladder Test Site. (A complete list of acronyms is shown in Table 3.2.) It is a text field of up to 10 characters and a foreign key in this table.

6. Media: The medium sampled. Examples are surface, subsurface, groundwater, surface water, and sediment. It is a text field of up to 50 characters.

7. Sampling_Method: The method used to collect the medium sample. It is a text field of up to 50 characters.

8. Sampling_Party_Name: The name of the organization and the name of the person taking the sample. It is a text field of up to 50 characters.

9. Sample_shipment_date: The date the sample was shipped from the field. It is a date/time field of 8 characters, but only the date is shown.

10. Analytical party: The name of the analytical laboratory that performed the analysis. It is a text field of up to 50 characters.

11. Sample_alias: If a duplicate was made of a sample, this is the real name of the sample from which the duplicate was made. This field is used to match duplicate samples with results from the original sample. It is a text field of up to 25 characters.

12. Sample_use: More information on the type of sample, such as whether it was used as a duplicate, background, quality assurance (QA), or regular sample. It is a text field of up to 25 characters.

13. Remark: Any notes about the sample provided by the field team. It is a memo field of unlimited length.

A.5 Sample_Location_Table

This table shows the coordinates where every sample was taken, as well as the sampling date, survey party, and sample depth, if necessary. The data are supplied by the survey party. This table is linked to the Sample_Data_Table by a many-to-one relationship. There are 10 fields in this table.

1. Sample_Location_ID: A unique number assigned by one of the Database Managers to each data record in this table to provide correct linkages between tables. It is a number field of 4 characters and the primary key of this table.

2. COC_Sample_Name: A chain-of-custody name assigned to the sample in the field by the team taking the sample. It is a text field of up to 50 characters and a foreign key in this table.

3. Sample_Date: The date the field sample was taken. It is a date/time field of 8 characters, but shows only the date. It is also a foreign key in this table.

4. X-Coord_Sample_UTMZone11: A north latitudinal coordinate (or northing) of the sample location in zone 11 of the Universal Transverse Mercator grid system. The coordinate is measured in meters from the equator. It is a number field of 4 characters.

5. Y-Coord_Sample_UTMZone11: A longitudinal coordinate (or easting) of the sample location in zone 11 of the Universal Transverse Mercator grid system. The coordinate is measured in meters from the central meridian in zone 11. Grid values west of the central meridian are less than 500,000 meters; to the east, they are more than 500,000 meters. It is a number field of 4 characters.

6. Coord_Survey_Method: The method used to determine the coordinates of the sample location. It is a text field of up to 50 characters.

7. Sample_Depth_From_(ft): The measurement, in feet, of the top of the sample. This is a number field of 4 characters.

8. Sample_Depth_To_(ft). The measurement, in feet, to the bottom of the sample. This is a number field of 4 characters.

9. Survey_Date. The date that the GIS survey of the sample location was taken. It is a date/time field of 8 characters, but only the date is shown.

10. Survey_Party. The name of the organization and the name of the person performing the GIS survey. It is a text field of up to 50 characters.

A.6 Well_Table

This table shows information on every well at YPG. Data include the site location, aquifer name, name/ID number of the well, installation date, and well specifications, such as screen depth and length, well material, and well size. The table is linked to the Groundwater_Level_Table in a one-to-many relationship and to the SWMU Table by a many-to-one relationship. There are 16 fields in this table.

1. Well_ID: A unique number assigned by one of the Database Managers to each data record in this table to provide correct linkages between tables. It is a number field of 4 characters and the primary key of this table.

2. Well_Name: The name of the well assigned by the well installer. It is a text field of up to 50 characters.

3. Site_Code: An acronym given to the SWMU. An example is FBTS, which is the acronym for Fuel Bladder Test Site. (A complete list of acronyms is shown in Table 3.2.) It is a text field of up to 10 characters and a foreign key in this table.

4. Screen_Aquifer_Name: The name of the aquifer where the well is installed. It is a text field of up to 50 characters.

5. Well_Type: The type of well. It can be a groundwater monitoring well, vadose zone monitoring well, proposed well piezometer, etc. It is a text field of up to 50 characters.

6. X-Coord_Sample: The X coordinate of the well location. The Universal Transverse Mercator (UTM) grid system is used. The coordinate is measured in meters from the equator (northing). This is a number field of 8 characters.

7. Y-Coord_Sample: The Y coordinate of the sample location. The Universal Transverse Mercator (UTM) grid system is used. The coordinate is measured in meters from the central meridian in zone 11 (easting). Grid values west of the central meridian are less than 500,000 meters; to the east, they are more the 500,000 meters. This is a number field of 8 characters.

8. Hole_Depth_(ft): The depth in feet to the bottom of the hole drilled before installing the well. This is a number field of 8 characters.

9. Screen_Depth_From_(ft): The depth in feet to the top of the well screen. This is a number field of 8 characters.

10. Screen_Depth_To_(ft): The depth in feet to the bottom of the well screen. This is a number field of 8 characters.

11. Ground_Elevation_(ft): The elevation, in feet above sea level, of the well location. This is a number field of 8 characters.

12. Top_Casing_Elevation_(ft): The elevation, in feet above sea level, of the reference mark on the top of the well casing, or, if no reference mark exists, the measurement to the top of the highest point on the well casing. This is a number field of 8 characters.

13. Well_Material: The construction material of the well. Examples include single-walled polyvinyl chloride (PVC) and stainless steel. It is a text field of up to 50 characters.

14. Well_Size_(in): The diameter of the well. It is a number field of 4 characters.

15. Installation_Date: The date the well was installed. It is a date/time field of 8 characters, but only the date is shown.

16. Abandoned_Date: The date the well was abandoned or no longer used for sampling. It is a date/time field of 8 characters, but only the date is shown.